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IMPACT OF ASTM STANDARDS AND GOVERNMENT REGULATIONS FOR ASBESTOS AND LEAD ON THE RENOVATION OF BUILDINGS

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ABSTRACT

The American Society for Testing and Materials (ASTM) is developing standards for controlling hazards from lead paint and asbestos that might arise during renovation of buildings. These voluntary, consensus-based standard practices, test methods and guides fill an essential role in managing environmental hazards. For example, Subcommittee E06.24 on Building Preservation and Rehabilitation Technology has issued a Standard Practice for Visual Inspection of Asbestos Abatement Projects, which describes a management approach used throughout the project. Inspection procedures and criteria are provided to determine if a removal project is complete before renovation of the space can proceed. Subcommittee D22.07 on Asbestos Sampling and Analysis has issued two standard test methods for asbestos in settled dust, using the Microvacuum surface sampling technique and analysis by Transmission Electron Microscopy. Subcommittee E06.23 on Abatement of Hazards of Lead in Buildings develops standards regarding lead paint in and near buildings, from evaluating building components and surroundings, to developing lead paint management plans, to management-in-place and/or hazard reduction, for the protection of workers, occupants and the environment.

1. INTRODUCTION

Consensus standards developed by private, non-profit organizations play an important role in the construction, renovation and maintenance of buildings in the United States (U.S.) and often complement government regulations. Recent legislation[1] directs federal agencies to use consensus standards and participate in their development, codifying a policy in effect since 1982.[2] Consensus performance specifications are the preferred way of describing the requirements of materials purchased by the federal government, and consensus standards are used in specifying materials, procedures and processes in building codes enforced by state and local agencies. A consensus standard, a document that has been developed and established within the consensus principles of a standards-writing body,[3] is voluntary until incorporated in a contract or regulation, at which time it becomes legally enforceable. The American Society for Testing and Materials (ASTM) is the

largest, not-for-profit organization in the U.S. devoted to writing voluntary consensus standards. ASTM provides a forum for producers, users, consumers and those having general interest to meet on common ground and write standards for materials products, systems, and services. Six principal types of standards: test method, specification, practice, guide, classification, and terminology. are written by volunteer members who serve on ASTM's technical committees.

When a need for a standard is recognized, the development process starts at the lowest organizational level of ASTM. Task Group members prepare a draft standard which is reviewed through a ballot sent to members of its parent Subcommittee. After the Subcommittee approves the document, it is submitted to concurrent Main Committee and full Society ballots. A member who justifies an objection to a provision of the draft standard and offers alternative wording may cast a negative vote at any level of the balloting process. All negative votes must be fully considered before the document can be submitted to the next balloting level. Usually, the Task Group first reviews negative votes received at any level of balloting and attempts to resolve the issue with the voter. The Task Group then recommends that its parent Subcommittee finds the negative vote either "persuasive" or "not persuasive," The Subcommittee formally votes on all "not-persuasive" recommendations by the Task Group, and the Main Committee considers negative votes found "not persuasive" by a Subcommittee as well as those received on a Main Committee or Society ballot. At all levels of balloting, the negative voter is informed in writing of the outcome, and the minutes are written to document the action for review by the Committee on Standards before the standard is published. For complicated or controversial standards, this process can result in four years or more for a standard to be issued. There is a provision for emergency issuance of standards on a temporary basis where a critical need is identified. Other mechanisms that ASTM uses to promote and maintain the quality of their standards include the balanced committee membership, with the number of producers being no more than the number of non-producers (users and general interest), and requirements for a 5-year periodic review and revision of all standards.

2. ASBESTOS

Because of the well-recognized health effects of inhaling asbestos fibers, controlling the potential hazards from asbestos-containing materials (ACM) in buildings has become a common and extensively regulated practice. These control measures include management of the ACM in occupied buildings and its abatement through removal or other means. One of the times that abatement frequently occurs is during renovation of a building.

ASTM Subcommittee E06.24 on Building Preservation and Rehabilitation Technology developed ASTM E 1368, Standard Practice for Visual Inspection of Asbestos Abatement Projects [1]. The first standard developed by and for the asbestos control industry, E 1368 was published in 1990 and recently revised. It describes a management approach to asbestos abatement that is used throughout the abatement project and culminates in its completion.

Conventional construction often relies on the contractor to perform the work according to the specifications, with inspection by the owner's representative upon completion of the project. The underlying premise is that contractors are legally and contractually responsible for the consequences of their work, and that owners and their representatives should not accept any part of that liability. ASTM E 1368 departs from that approach out of recognition of the potentially serious implications for the health of building occupants from an improperly-conducted abatement project . Whereas one can tear down and rebuild a defective wall, it is another matter to remedy contamination of a building and one obviously does not put the asbestos back in and start over. Therefore, E 1368 encourages active and continuous involvement of the owner's representative through all phases of the project to achieve early resolution of problems through cooperative effort by the building owner, abatement contractor and the owner's representative, who is called the inspector in the standard.

E 1368 considers knowing the location of the asbestos to be removed, and the extent of the abatement, as essential to conducting the project and the visual inspections. Figure 1 relates the visual inspection process to the building survey, which may be thought of as the foundation for the abatement activities from PROJECT DESIGN through FINAL AIR SAMPLING. Although Figure 1 indicates REMOVAL, other abatement methods such as encapsulation and enclosure are also used.

A fundamental premise of E 1368 is that the scope of the abatement work must be clearly spelled out. The "limits of abatement" are based on, but may not be identical to, the limits of construction for the renovation. This information is developed during the PROJECT DESIGN phase. Determining the location and quantities of ACM, particularly in concealed spaces, often requires a more thorough inspection of the area affected by the renovation and abatement that had been performed during the initial building survey.

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[1] ASTM standards mentioned in this paper may be obtained from: ASTM Customer Service, 100 Barr Harbor Drive, West Conshohocken, PA, 19428, USA. 01-610-832-9585.

The inspector begins regular visits to the work site early in the PREPARATION phase, when walls, floors and equipment are covered with plastic sheets for protection against contamination. The inspector approves the preparations before the REMOVAL phase begins. The standard describes in detail the procedures and criteria for performing two visual inspections at the conclusion of the project (Figure 2). The contractor's supervisor and workers provide assistance during these inspections. At the completion of the REMOVAL phase, the inspection for completeness of removal verifies that all ACM that the contract requires to be removed is gone, and that the substrate or components on which it had been applied or installed is free of visible residue. After a sealer is applied to these abated surfaces to "lock down" invisible fibers, the CLEAN-UP phase begins. During this phase, plastic sheets that had protected the walls, floors and items remaining in the enclosure from contamination are cleaned and removed. The protected surfaces are themselves cleaned, and then the second inspection -- for completeness of clean-up -- is performed. There can be no visible debris in the work area at this time; in fact, *the area should be as clean as it has ever been, and as clean as it ever will be*. Only after this inspection is passed is FINAL AIR TESTING for clearance performed. If these air samples show airborne fiber concentrations below the limit stated in the specification, the inspector signs a certificate of completion and the area is released for the renovation to proceed.

E 1368 also describes visual inspection procedures and criteria for abatement by encapsulation and enclosure, in crawl spaces under buildings, for dry removal, and with glove bags for pipe insulation. Inspection procedures for Operations and Maintenance, often referred to as O&M or "managing-in-place," are also provided. Detailed information on the use of E 1368 and the visual inspection process for management of abatement projects and O&M programs is provided in the ASTM *Manual on Asbestos Control.*[4]

E 1368 is widely referenced in specifications, regulations and training materials. One of the concepts basic to E 1368 -- prompt clean-up of removed material and debris -- is among the three methods of compliance required by the U.S. Occupational Safety and Health Administration (OSHA) asbestos regulations for the construction industry.[5] Another key concept -- knowing the location of the asbestos and the extent of the intended abatement -- is consistent with U.S. Environmental Protection Agency (EPA) regulations that require inspection of the affected area for asbestos that is likely to be disturbed.[6] Other EPA regulations require that courses for individuals who design abatement projects include training in visual inspection and its relationship to final air testing.[7]

Another standard that finds more limited use during abatement is ASTM E 1494, Practice for Encapsulants for Spray or Trowel-Applied Friable Asbestos-Containing Building Materials. This standard describes procedures for testing the adhesion, cohesion and depth of penetration of encapsulants applied to fireproofing and acoustical plaster that is intentionally left in place.

In 1995, Subcommittee D22.07 on Asbestos Sampling and Analysis issued ASTM D 5755, Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Concentrations, and D 5756, a test method for determining mass concentrations, of asbestos in dust on surfaces. These test methods involve collection of a dust sample by using a filter cassette and a low flow-rate (2 liters/minute) air sampling pump as a miniature vacuum cleaner. The contents of the cassette are analyzed by Transmission Electron Microscopy and a result calculated in structures/cm^2 or grams/cm^2 of surface area sampled. These methods are not intended for abatement project clearance, but are finding increasing use in the study of fiber transport mechanisms in air plenums, and in evaluation of cleaning techniques used in O&M programs for asbestos.

3. LEAD - BASED PAINT

About 1.7 million U.S. children under six years of age have blood lead levels at or above 10 mg/dl, a level considered to be "of concern" for nervous system effects such as reading and learning disabilities, reduction in attention span, and behavioral problems.[8] The high cost of abating lead-based paint in affected residences by removal, encapsulation or enclosure has prompted a national control strategy that allows lead-based paint to remain, subject to various governmental actions to reduce lead exposures, [9] [10] such as: requiring communication of known information on the presence of lead-based paint or its hazards when transferring, selling or leasing residences; requiring certain inspections and hazard reduction activities to be performed for residences owned (or assisted financially) by the federal government; establishing training and certification quality controls over most lead-based paint inspection and abatement activities in residential properties, and controlling occupational exposures to lead.

Several ASTM committees are addressing lead-based paint issues. E06 on Performance of Buildings develops step-by-step procedural guidance and methods for managing building operations, for maintenance and for hazard control projects. E51 on Environmental Risk Management provides

baseline standard-of-care procedures for commercial and residential building owners and managers. D22 on Sampling and Analysis of Atmospheres develops methods for collecting and analyzing airborne particulate samples, including lead, supplementing Committee E06 standards on this topic.

Since its establishment in 1991 at the request of the U. S. Department of Housing and Urban Development (HUD), ASTM Subcommittee E06.23 on Abatement of Lead Hazards in Buildings has produced over two dozen standards, which are shown in Table 1. As of May, 1996, seventeen standards had been adopted by the Society as full standards (E designation) and two as provisional standards (PS). Thirteen standards were in advanced stages of balloting, and fifteen standards (not listed) were in early stages of development. This high rate of productivity can be attributed to task groups whose members widely reflect the interested segments of industry, government and academia while focusing on carefully-defined lead hazard issues, and the technical and managerial competence of the Subcommittee's leadership and members in drafting, reviewing and promptly resolving conflicts on proposed standards. Standards produced by the Subcommittee fall into four categories: sampling and analysis of field samples; field assessments of lead-based paint and its hazards; control of lead-based paint and abatement of its hazards; and quality assurance and safety. The Task Groups, shown in Table 2, fall into the same categories as the standards listed in Table 1.

Subcommittee E51.04 on Loss Control for Commercial and Industrial Buildings has issued a provisional Standard Guide for Prevention and Control of Lead-Based Paint Hazards in Rental Housing, describing baseline recommended essential maintenance practices, actions in response to notification of an elevated blood lead child, and control of identified lead-based paint hazards. Task Group E06.23.72 is drafting a Standard Guide For Identification And Management of Lead Hazards in Buildings, a document which will integrate all of the standards originated by the Subcommittee and other ASTM committees with other applicable standards and guidance from private sector consensus organizations (such as the National Institute of Building Sciences [11]) and government agencies, including EPA, HUD [12], OSHA, and the U.S. Army Corps of Engineers.[13] This Standard Guide will be particularly useful for owners who manage lead issues in several buildings on a common basis while tailoring the guidance for each building to local conditions.

An overview of the lead paint identification and hazard management process described in the draft Standard Guide is shown in Figure 3. The process begins with categorizing facilities for the presence or likely presence of lead-based paint or its hazards through records review of construction date, the presence or absence of lead-based paint and of other sources of lead dust, the use, condition and

location of the facilities with respect to external (environmental) sources of lead, and of lead levels in water supplied to the facility. Visual and physical examinations of the facilities for the lead content and condition of paint and dust, and screening, inspections, and risk assessments are also used, depending on the goals of the owner, manager, or tenant. Intervening with respect to lead hazards includes applying interim dust controls or paint stabilization, abating hazards by removal, encapsulation or enclosure of the lead-based paint, and removing plumbing components which leach significant lead levels into drinking water, and performing other lead hazard control projects. Maintenance and cleaning programs incorporate lead hazard controls, and are complemented by worker and occupant lead safety programs. Responding to incidents of elevated blood lead levels in young children uses protocols developed by the U.S. Centers for Disease Control and Prevention. Personnel and organizations must be qualified for all of these activities, and appropriate environmental and occupational sampling and analysis are performed to guide the activities. By monitoring and re-evaluating conditions regularly, the program can be revised as needed.

4. CONCLUSION

Standards and related publications developed by ASTM committees help to guide users through the complex set of governmental regulations and guidance documents, complementing other resources available from the private sector. With the emphasis on use of private-sector consensus standards by federal agencies, ASTM standards will have an increasing effect on inspection, detection, management, abatement and waste disposal activities for asbestos and lead, and the importance of these standards will continue to be recognized by governmental agencies and others.

REFERENCES

[1] Public Law 104-113, "Technology Transfer Improvements Act of 1995," March 7, 1996.

[2] Circular No. A-119, "Federal Participation in the Development and Use of Voluntary Standards," Office of Management and Budget, Washington, DC, USA, 1982. Revised October 20, 1993.

[3] Regulations Governing ASTM Technical Committees, American Society for Testing and Materials, West Conshohocken, PA, September, 1994.

[4] Andrew F. Oberta, *Manual No. 23 on Asbestos Control: Removal, Management and the Visual Inspection Process*. American Society for Testing and Materials, West Conshohocken, PA, USA. November, 1995.

[5] *Occupational Exposure to Asbestos: Final Rule.* Title 29, Code of Federal Regulations (CFR) Parts 1001, 1915 and 1926. U. S. Department of Labor, Occupational Safety and Health Administration, Federal Register, page 40964, August 10, 1994.

[6] *National Emission Standards for Hazardous Air Pollutants: Subpart M - Asbestos.* 40 CFR Part 61. U. S. Environmental Protection Agency, Federal Register, page 48406, November 20, 1990.

[7] *Asbestos Model Accreditation Plan: Interim Final Rule,* 40 CFR Part 763. U.S. Environmental Protection Agency, Federal Register, page 5236, February 3, 1994.

[8] *Preventing Lead Poisoning in Young Children,* U.S. Centers for Disease Control and Prevention, Atlanta, GA, USA. October 1991.

[9] Public Law 102-550, Housing and Community Development Act of 1992: Title X - The Residential Lead-Based Paint Hazard Reduction Act of 1992.

[10] "Lead Exposure in Construction: Interim Final Rule," 29 CFR 1926.62. U. S. Department of Labor, Occupational Safety and Health Administration., Federal Register, May 4, 1993.

[11] *Lead-Based Paint Operation and Maintenance Work Practice Manual for Homes and Buildings,* May 1995, and *Guide Specifications for Reducing Lead-Based Paint Hazards,* National Institute of Building Sciences, Washington, DC, USA. May 1995.

[12] *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing,* HUD-1539-LBP, July 1995, and *Putting the Pieces Together: Controlling Lead Hazards in the Nation's Housing,* HUD-1547-LBP, U.S. Department of Housing and Urban Development, Washington, DC, USA. July 1995.

[13] *Guide Specification for Military Construction,* CEGS 02090, *Lead Based Paint Abatement and Disposal,* April 1994, and *Lead Based Paint Lead Hazard Containment Detail Setup Drawings,* U.S. Army Corps of Engineers, April 1994.

Table 1. ASTM E06.23 Standards on Lead Hazard Abatement and Control (as of May, 1996)

COLLECTION AND ANALYSIS OF FIELD SAMPLES		CONTROL AND ABATEMENT	
Collection		Non-reinforced liquid encapsulant specification	E 1795
Soil	E1727	Reinforced liquid encapsulant specification	E 1797
Paint film	E 1729	Encapsulant selection and use	E 1796
Dust (wipe)	E1728	Paint removal	In ballot
Air particulate	E 1553	Identification & Management of Lead Hazards in Buildings	In ballot
Dust (vacuum)	PS 46	**FIELD ASSESSMENTS**	
Dust wipe specification	E 1792	Spot test kit use for paint	E 1753
Waste sampling	In ballot	Evaluating performance of selected on-site analyses	E 1755
Digestion		Evaluating performance of spot test kits	In ballot
Paint film	E 1645	X-ray fluorescence paint inspection	In ballot
Soil	E 1726	XRF performance parameters	In ballot
Dust (wipe)	E 1644	Visual inspection of paint condition	In ballot
Air particulate	E 1741	XRF soil measurement	In ballot
Ultrasonic (all media)	In ballot	Risk assessment	In ballot
		Sampling design	In ballot
Analysis		**QUALITY ASSURANCE AND SAFETY**	
Portable electro-analysis	In ballot	Worker safety	In ballot
FAA, GFAA, ICP	E 1613	Evaluating traditional laboratories	E 1583
		Quality systems for hazard assessment entities	PS 45
		Terminology	E 1603

Table 2. ASTM Subcommittee E06.23 Task Group Designations

COLLECTION AND ANALYSIS OF FIELD SAMPLES		CONTROL AND ABATEMENT	
.10	XRF measurement of lead-paint in buildings	.20	Removal
.11	Performance evaluation of XRF paint analyzers	.30	Encapsulants
.12	XRF field measurement of lead in soil	.41	Contractor certification
.16	Laboratory test and collection methods	**FIELD ASSESSMENTS**	
.71	Testing design	.14	Visual assessment of paint condition
		.70	Qualitative risk assessment
Note: Task Groups are designated as E06.23.XX		**QUALITY ASSURANCE AND SAFETY**	
		.40	Laboratory accreditation/field quality systems
		.50	Terminology
		.60	Worker safety
		.72	Management of lead in buildings

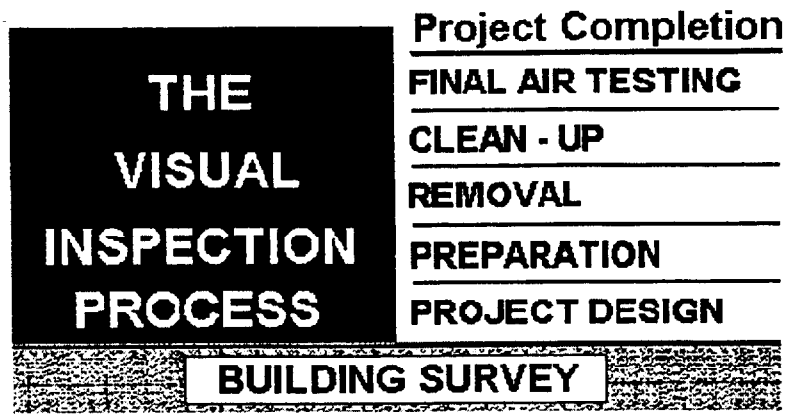

Figure 1. The building survey provides the foundation for the abatement project and the visual inspection process

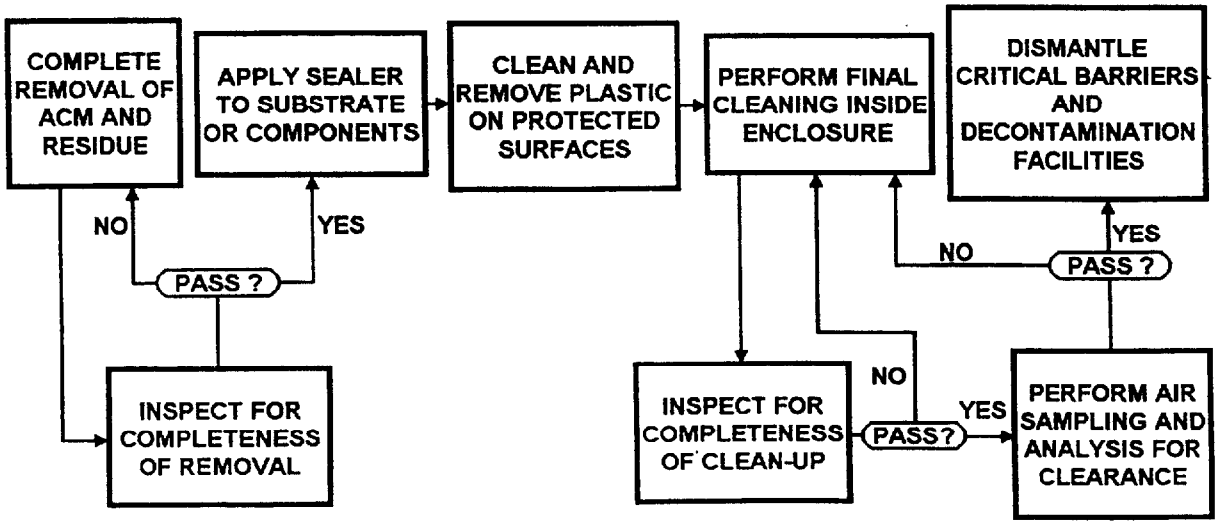

Figure 2. There are two visual inspections during the concluding activities of an abatement project.

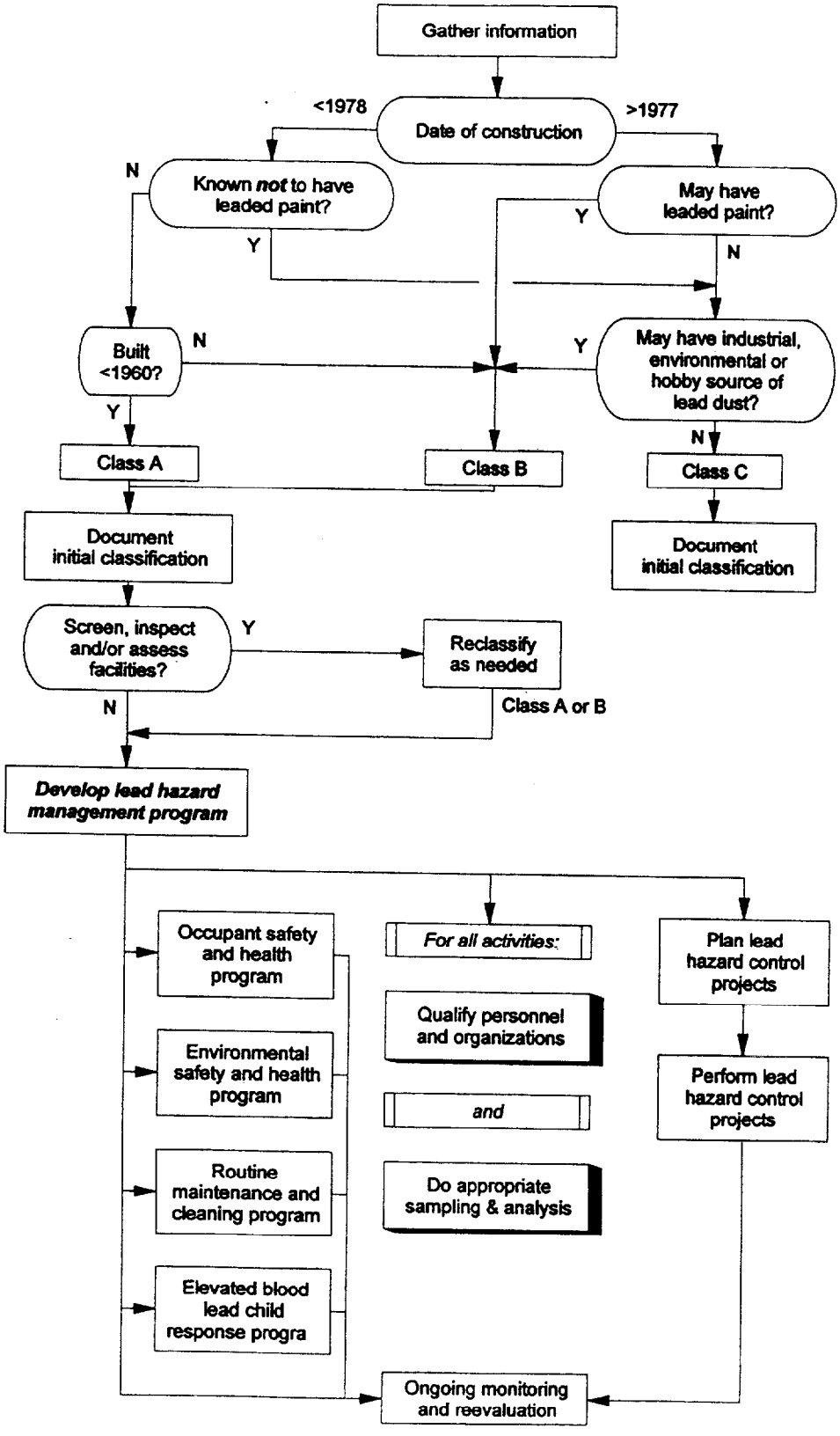

Figure 3. Overview of Lead Paint Identification and Hazard Management Program